IMPACTS OF RISING ENERGY PRICES ON SWINE HOUSING AND WASTE DISPOSAL*

D. Lynn Forster**

Energy has been a household word in the 1970's. Agricultural producers usually have a negative reaction to the word since it has been translated into higher costs at the farm level. Farmers have seen prices they pay for gasoline, fuel oil, and electricity escalate rapidly since 1973. They have seen fertilizer rise dramatically, reflecting the higher costs of inputs into fertilizer manufacturing. Other purchased inputs -- tractors, combines, fences, etc. -- have also risen as the energy costs in manufacturing these have increased.

Our purpose this afternoon is twofold:

1. Review the economic and political environment which has led to high energy prices.
2. Project the impact of changing energy prices on swine housing and manure disposal technology.

All of us have one thing in common in evaluating the impacts of energy on our situation -- uncertainty. We have little knowledge of the probability of future occurrences in the energy area. Energy prices rose

---

*Presented to the Ohio Pork Producers Council, January 25, 1976.

**Assistant Professor, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio.

quite suddenly, and they may fall even faster. The oil producing countries may choke supplies even further, or the cartel may disintegrate and supplies come gushing forth. It seems that producers must expect to face uncertainty with regard to energy in the near future.

We will attempt to analyze this uncertainty and its impacts by assuming the worst -- a doubling of energy prices. Our analysis will trace the impact of this price increase on the cost of selected housing and manure disposal systems.

Background of "Energy Crisis"

To review the events of the past few years which have led to our "energy crisis," we will concentrate on the changing worldwide supply and demand for energy. How did we get to another "crisis" situation? Or is the energy situation really a "crisis"?

Let's look briefly at the supply of energy. Energy resources and available supplies are different concepts. Energy resources are all around us. We tend to be myopic in our view of energy by assuming that oil, coal, natural gas and maybe uranium are the only sources which we have at our disposal. Quantities of energy available depend upon the technologies available for using them in a productive manner, relative prices of energy in comparison with other commodities, and institutional restrictions on its use. The technologies limiting useful adaptation of energy is really in short supply and not energy per se. We have ample supplies of coal and

fuel wood; however, our mobile society does not have a manner of economically converting coal and wood to fit all of its needs.

Table 1 illustrates the abundance of our energy resources. The statistics which are usually presented compare our current production with known reserves. The proven reserves are simply a working inventory of the oil and gas producing industry. The process of further resource development is a continuous one and depends upon the economic incentive for exploration and development. Provided we give abundant incentive to development, our usable reserves would approach the "recoverable resources" level. The "remaining resource base" is the total energy endowment of the world. Much of the energy we find is simply not recoverable with current technology. For example, the oil wells from which we pump have large quantities of oil which are not able to be recovered as the oil clings to the nearby soil particles.

These abundant energy reserves do not mean that we have abundant available energy supplies. Our energy "shortages" have developed due to our reliance on one primary form of energy and the location of that particular form. We have steadily increased our use of petroleum as an energy source due to its abundance and inexpensive price. Figure 1 illustrates the sources of energy on which the U.S. depends. This projection shows U.S. petroleum providing 30.9 percent of our energy needs in 1972, but only 23.7 percent of our needs in 1980. At the same time, our reliance on oil remains high and we are forced to import oil from OPEC nations.

The reasons why we have developed such a dependence on foreign oil is a complex topic which we will not cover in detail. The reasons can be summarized as the following:

1. Oil supplies in OPEC nations are abundant and prices for oil have been historically inexpensive. Figure 2 illustrates the real price of oil over the past 25 years.
2. Domestic policies have encouraged foreign exploration.
   a. Domestic prices have been controlled and are likely to continue to be controlled. These prices have discouraged production from existing wells.
   b. Low prices have discouraged exploration. Abundant supplies at low cost were available from the Middle East.
   c. Tax laws encouraged foreign investment. Any taxes paid to foreign governments could be deducted from the tax bill. Thus, most payments for oil were not expense items but were offset against the company's tax liability.

At the same time we were developing our dependence on foreign oil, two critical events were occurring. First, oil companies were gradually losing control of the foreign oil supplies. Foreign governments continually asserted the position that the oil belonged to them and that they should receive a larger share of the revenues. As revenues increased, their power

with the oil companies increased until they were able to take over most of the oil supplies. While their power over their own wells was growing, the U.S. was helping to drive such diverse countries as Venezuela, Colombia, Saudi Arabia, Libya, Kuwait, etc., into an organization called OPEC. This organization resulted primarily from the imposition of import quotas on oil and the depressing effect which this restriction had on foreign oil prices.

On the demand side, our consumption of energy has corresponded closely with the level of our Gross National Product. Our national income has been promoted by an inexpensive source of energy. We have tended to develop with capital intensive technologies relying on an inexpensive energy to fuel them. An example is our pork production, which has developed confinement technology without considering energy as a restrictive resource. We have moved to a system where we rely heavily on energy to harvest and transport our feedstuffs, to provide heat for our housing, and to dispose of the manure. Moreover, we rely on equipment and buildings which were built with a large requirement for energy sources of natural gas and petroleum.

With our current technologies and price relationships, we can expect the quantities of energy demanded to continue to increase in agriculture, as well as our national economy. It is estimated that by 1980 agriculture will need about 8 percent more LP gas, 19 percent more natural gas, and 19 percent more petroleum to market our food products. For our national economy, it is estimated that we will be using approximately 50 percent more energy by 1985 than we are currently using. We can expect our energy

demand to remain high, even with high prices forced upon us by OPEC countries. Furthermore, we can expect our economy to continue to grow with higher energy prices and to demand more quantities of energy.

It would appear that our dependence on foreign oil will remain over the next few years. Our demand for energy is quite inelastic. That is, any change in price will be met by decreased utilization, but the percentage reduction in quantity consumed is far less than the percentage increase in price. We will make adjustments in our energy usage -- more insulation, more car pooling, shorter vacation trips, lighter cars, lower thermostat settings, etc. However, it is projected that energy demands will grow by nearly 3 percent per year over the next decade. Foreign oil will be a vital source in order to achieve this growth. We can not expect the new thrust in energy research to do much for us within the decade.

We can also expect to see the OPEC nations continue their efforts to force the price of oil up through cartel agreements. The U.S. will make noise about increasing domestic energy production, but political considerations will continue to dampen economic incentives to produce domestic oil. In summary, we will continue to rely on imports. The question remains as to whether the OPEC countries can maintain the cartel or whether individual countries will begin price cutting and eventually destroy the cartel.

Effects of High Energy Prices on Pork Production

Assume for a minute that the oil cartel is quite effective in its pricing. Let's assume that it is capable of forcing a doubling of all energy prices.

That is, all supplies of energy -- electricity, gas, oil, diesel fuel, LP gas, etc. -- increase by 100 percent. What might be the effect on hog production systems?

Some insights into the effect of such a jump in energy prices can be obtained by analyzing the resulting costs of two hog production systems. The first system relies more on labor and less on fossil fuel -- the two litter, pasture system. The other is one which relies heavily on fossil fuel -- the slotted floor confinement system.

The total costs of the pasture system are shown in Table 1, before and after the energy price increase. An effort has been made to project how prices would increase for all inputs if energy prices increased. These price increases include both the direct and indirect effects of higher energy prices. We would expect our feed costs to increase substantially due to the high energy requirements of fertilizer, herbicides, insecticides, machinery and so forth. In Table 2 we see corn increasing by 35 percent. Supplement would also increase by approximately this amount. The cost of living would rise by approximately 10 percent, and the labor charge has been increased by this amount in Table 2. Electricity and fuel would increase by 100 percent, and the cost of our durable inputs would increase approximately 30 percent. Our total costs show a 26 percent increase.

A similar projection has been made in Table 3 for the farrow to finish confinement system. As we might expect, its costs increase more than those of the pasture system. We have more electricity and fuel, although

they remain a small portion of the total cost. We have more capital investment and higher costs of using this capital as reflected in fixed costs. Total costs increase nearly 33 percent under the confinement system, compared to 26 percent under the pasture system.

Notice the relatively small impact it has had on the choice between the systems. According to these budgets, total costs per sow on the pasture system were 6 percent higher than total cost in the confined system. After the energy price increase, total costs in the pasture system still would be 1 percent higher than the costs in the confinement system.

Energy prices do have an impact on costs of housing systems, but these impacts have surprisingly small impacts on the way we raise hogs. The point is that all of our systems require energy since they all depend on a capital intensive agriculture.

Another impact which we would feel under a 100 percent increase in the price of energy would be the increasing value of manure as a source of plant nutrients. As energy prices increase, fertilizer prices increase, and manure would become increasingly valuable as a substitute for commercial nutrients.

Table 4 illustrates the value of nutrients in manure before and after a 100 percent increase in energy prices. Those systems which have a higher value of manure per animal are those which have less nitrogen losses due to storage and handling. Generally, the value of manure as a commercial nutrient substitute would increase about 35 percent.

Manure disposal costs also increase as a result of higher energy prices. Under current price relationships, manure disposal costs are approximately $3.90 per head sold for the confined, 90-100 sow system, as shown in Table 5. The higher energy prices would increase these costs to $5.10 per head sold. Thus, the old rule of thumb that manure disposal is a breakeven proposition holds with higher energy prices. Increased energy costs raise the costs of manure disposal about as much as it raises the benefits.

Summary

We have witnessed dramatic changes in the price of energy during the decade of the 1970's. Imported petroleum prices have increased from $2.36 per barrel in 1970 to $11.53 per barrel in 1975. The situation has resulted from increased reliance on oil as the form of our energy, increased development using capital and energy intensive inputs, heavy dependence on a singular source of oil, and domestic policies which encouraged foreign development at the expense of the development of domestic sources.

We can expect a large jump in the price of energy to severely affect the cost of production of hogs under a variety of housing systems. The two litter, pasture system shows a 26 percent increase in the cost of production when energy prices are doubled. Likewise, the confinement system shows a 33 percent increase in costs.

These huge price jumps would only have a marginal impact on the method by which we raise hogs. Capital intensive and energy intensive

systems would tend to be replaced by systems which better conserve high priced energy. However, the shifts in housing systems would not be severe.

Similarly, the increased benefits of manure as a substitute for higher priced commercial fertilizer would be mitigated by increased disposal costs. We could expect the rule of thumb that manure disposal just about pays for itself to hold before and after the energy price increase.

TABLE I
MAJOR ENERGY RESOURCES OF THE WORLD
(QUADRILLION BTU's)

Source	1972 Production	Cumulative Production[a]	Reserves[b]	Recoverable Resources[c]	Remaining Resource Base
Petroleum	108	1,550	3,680	14,400	60,000
Shale oil	--	--	1,100		12,000,000
Tar sands	--	.6	1,000	2,150	N/A
Natural gas	53	670	1,860	15,800	32,000
Coal	79	3,340	N/A	N/A	340,000
Uranium--					
used in reactors	N/A	N/A	510	990 650	,000,000
used in breeders	--	--	40,000	77,000	600 billion

a "Cumulative production" is total use of resource in past

b "Reserves" is proven reserves or recoverable portion from existing wells

c "Recoverable resources" is an estimate of the total energy supplies which may be recovered

d "Remaining resource base" is hypothesized upper limit on the amount of source which is in the earth

Source: H. J. Frank and J. J. Shang, "The Economics of the Energy Problem," Joint Council on Economics Education, 1975.

TABLE 2

PASTURE SYSTEM

Expenses - Farrow to Finish Hog Production Budget, 1976, Before and After Doubling Energy Prices

	Before 100% Increase in Price of Energy ($/sow)	After 100% Increase in Price of Energy ($/sow)
Variable Expenses		
Feed		
Corn	564	761
Supplement	198	261
Creep Feed	45	60
Labor	165	182
Vet & Medicine	19	22
Breeding	10	10
Marketing	30	38
Elec. & Fuel	31	62
Misc.	48	53
Interest on Opr. Capital	39	51
Interest on Breeding Herd	26	26
Total Variable Cost	1175	1472
Fixed Expenses		
Equipment	100	130
Buildings	34	44
Land	12	13
Total Fixed Cost	146	187
Total Cost	1321	1662

TABLE 3

CONFINEMENT - HIGH INVESTMENT SYSTEM

Expenses - Farrow to Finish Hog Production Budget 1976, Before and After Doubling Energy Prices

	Before 100% Increase in Price of Energy	After 100% Increase in Price of Energy
	$	$
Variable Expenses		
Feed		
Corn	523	706
Purchased	245	323
Labor	98	108
Vet & Medicine	14	16
Breeding	7	7
Marketing	31	39
Elec. & Fuel	48	96
Misc.	17	19
Interest on Opr. Capital	35	48
Interest on Breeding Herd	22	22
Total Variable Cost	1040	1384
Fixed Expenses		
Equipment	90	117
Buildings	111	144
Total Fixed Costs	201	261
Total Costs	1241	1645

TABLE 4

BENEFITS OF SWINE MANURE PER HEAD SOLD
AS A SUBSTITUTE FOR COMMERCIAL FERTILIZER,
BEFORE AND AFTER DOUBLING ENERGY PRICES

Housing System	Before 100% Increase In Price of Energy ($/hog sold)	After 100% Increase In Price of Energy ($/hog sold)
Bedded buildings, solid spreading	4.6	6.5
Aerobic lagoon, liquid spreading	3.7	5.2
Deep pit storage liquid spreading	3.4	4.7
Oxidation ditch, anaerobic lagoon, liquid spreading	3.1	4.2

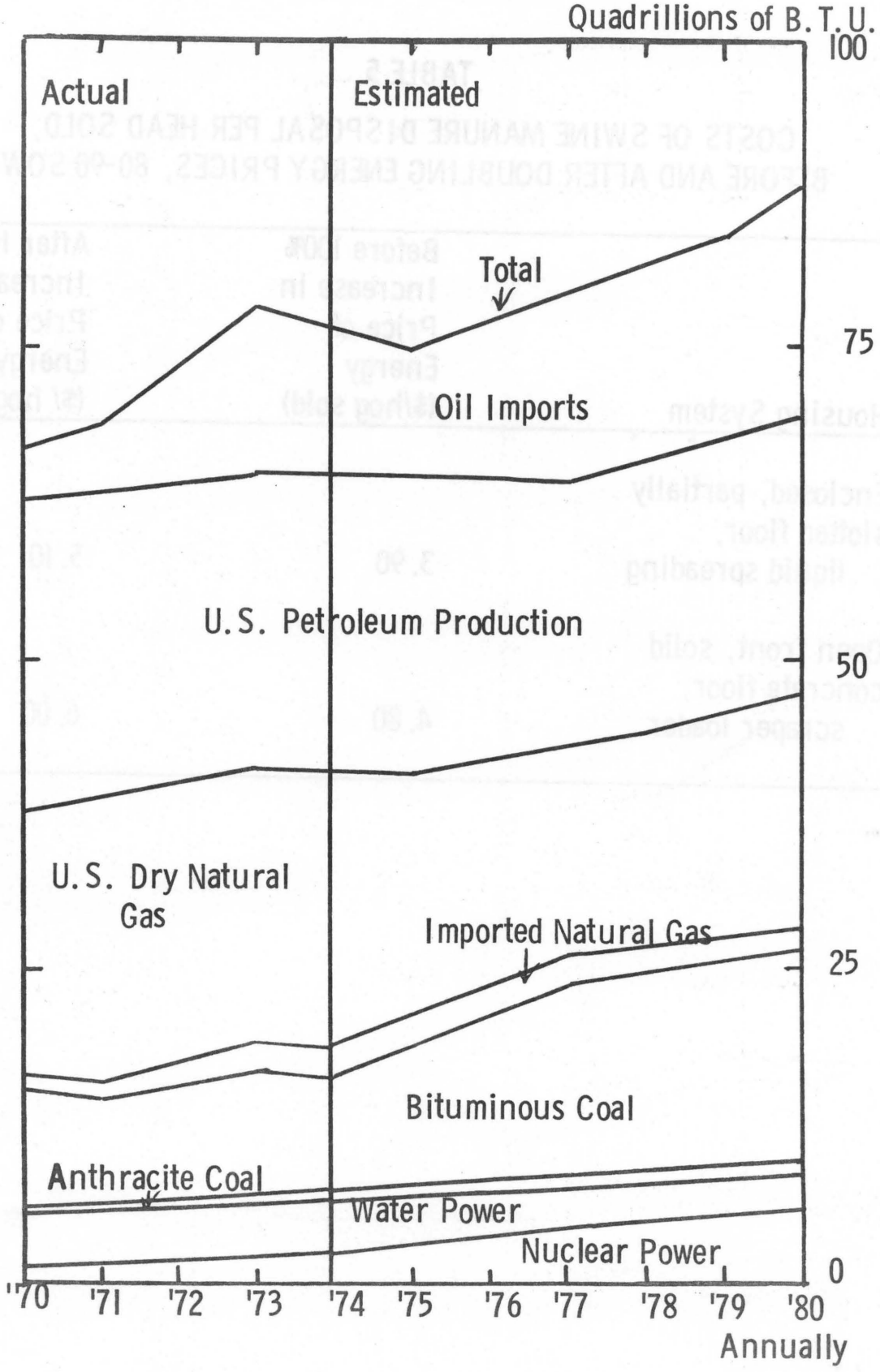
TABLE 5

COSTS OF SWINE MANURE DISPOSAL PER HEAD SOLD, BEFORE AND AFTER DOUBLING ENERGY PRICES, 80-90 SOW

Housing System	Before 100% Increase in Price of Energy ($/hog sold)	After 100% Increase in Price of Energy ($/ hog sold)
Enclosed, partially slotted floor, liquid spreading	3.90	5.10
Open front, solid concrete floor, scraper loader	4.80	6.00

FIGURE I

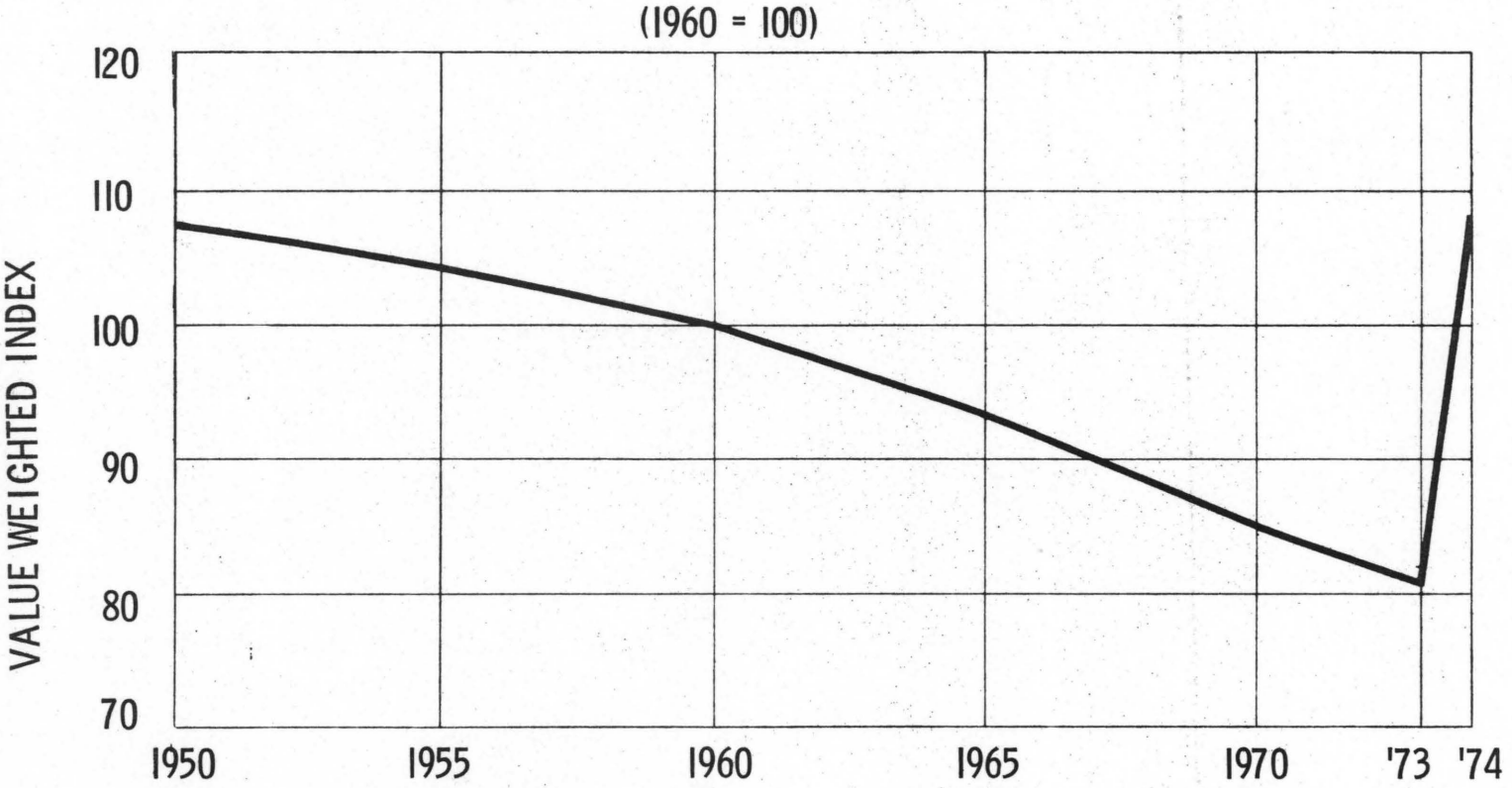
SOURCES OF U.S. ENERGY



Sources: U.S. Department of Interior, Island Creek Coal Company

FIGURE 2

THE PRICE OF ENERGY, 1950 - JUNE 1974



Source: Edward J. Mitchell, U.S. Energy Policy: A Primer (Washington, D.C.: American Enterprise Institute, 1974), Table A-3, p. 82. Updated by the AEI National Energy Project staff.